## REMARKS

Claims 1-27 are pending in this application. Claim 15 has been canceled. Claims 12, 16, and 20 have been amended. In the Office Action dated March 12, 2004, the Examiner rejected claims 1-2 and 11 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,278,114 to Mitsui ("Mitsui"). The Examiner further rejected claims 12-14 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,834,783 to Muraki et al. ("Muraki"). Claims 4-8 have been rejected under 35 U.S.C. § 103(a) as being obvious over Mitsui and U.S. Patent No. 4,600,839 to Ichihashi et al. ("Ichihashi"). Claims 15-17 and 19 were further rejected under 35 U.S.C. § 103(a) as being obvious over Muraki et al. as applied to claim 12 above, and further in view of Ichihashi. Claims 20-22 have been rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 4,868,395 to Kasahara et al. ("Kasahara") in view of Muraki. Finally, claims 23-27 have been rejected under 35 U.S.C. § 103(a) as being obvious over Kasahara and Muraki as applied to claim 20 above, and further in view of Ichihashi.

Applicants disagree with these rejections and wish to clarify various distinctions over the cited references. Reconsideration of the application is therefore requested in light of the present amendment and following remarks.

The disclosed embodiments of the present application will now be discussed in comparison to the cited references. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the cited references, do not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner appreciate important claim distinction discussed thereafter.

In one embodiment shown in Figure 1, an apparatus for measuring the dimensions of semiconductor features is disclosed. The apparatus includes an electron gun 30 positioned above a stage 40 that supports a semiconductor substrate 20 being measured. The stage 40 may be moved relative to an electron beam 34 in any of the x, y, or z planes. The electron beam 34 emitted from the electron gun 30 passes through a condenser lens 31 and then through an aperture 32. The electron beam 34 then passes through the objective lens 33 that further concentrates the electron beam. In operation, a feature of the semiconductor substrate 20 may be scanned by a first electron beam 34′ having a first depth of focus to create a first reflected

electron beam and by a second electron beam 34″ having a second depth of focus. By focusing the first electron beam 34′ on one portion of the feature and the second electron beam 34″ on another portion of the feature, the various dimensions of the feature may be measured by detectors 50*a* and 50*b* detecting the reflected or emitted electrons from the semiconductor substrate 20.

In another embodiment shown in Figure 5, the apparatus for measuring the dimensions of semiconductor features includes an electron gun 230 positioned above a stage 240 that supports a semiconductor substrate 20 being measured. The apparatus further includes a condenser lens 231 and a port surface 232 that comprises a first port 232*a* and a second port 232*b*. Electrons emitted from the electron gun 230 pass through the condenser lens 231 and through the first port 232*a* and second port 232*b*. By passing through the first port 232*a* and second port 232*b*, two electron beams 235*a* and 235*b* are formed, wherein each respective electron beam 235*a* and 235*b* then passes through a corresponding condenser lens 233*a* and 233*b* to be focused on the semiconductor substrate 20. In operation, each of the electron beams 235*a* and 235*b* may have a different depth of focus. In another embodiment, one of the ports 232*a* and 232*b* may be blocked and the semiconductor substrate 20 scanned by only one electron beam at a time. The other port may be unblocked and the semiconductor substrate 20 may scanned by the other electron beam. In another embodiment, the semiconductor substrate 20 may be scanned by both electron beams 235*a* and 235*b* simultaneously to advantageously reduce the scan time.

In another embodiment shown in Figure 6, the apparatus for measuring the dimensions of semiconductor features includes two electron guns 330*a* and 330*b* positioned above a stage 340 that supports a semiconductor substrate 20 being measured. Electrons emitted from the electron guns 330*a* and 330*b* form electron beams 335*a* and 335*b* which pass through a corresponding condenser lens 331*a* and 331*b*. The ports 332*a* and 332*b* in a port surface 332 receive the corresponding electron beams 335*a* and 335*b* from the condenser lens 331. Upon passing through the port surface 332, each electron beam 335*a* and 335*b* passes through a corresponding objective lens 333*a* and 333*b* to focus the electron beams on the surface of the semiconductor substrate 20. In operation, each electron gun 330 may be individually controlled and the corresponding depth of focus of the electron beams 335*a* and 335*b* may be controlled by their respective condenser lens 331 and objective 333.

The Mitsui reference cited by the Examiner is directed toward an electron microscope for measuring a dimension of a feature of specimen. While the Mitsui reference discloses a stage 15 configured to move a wafer thereon, it does not expressly or inherently disclose a stage that is movable in any of the x, y, or z planes.

The Muraki reference, which was also cited in the Office Action, is directed to electron exposure apparatus for exposing semiconductor wafers. The apparatuses disclosed in the Muraki reference are used for forming images on the semiconductor wafers. These types of apparatuses are employed in electron beam lithography for exposing patterns on a resist disposed on a semiconductor wafer. The Muraki reference does not disclose or fairly suggest employing any type of detector for detecting electrons reflected or emitted from the semiconductor wafer that the images are formed on.

The Examiner has also cited the Ichihashi reference, which is directed to a scanning electron beam system for measuring small dimensioned features of a sample. Referring to Figure 2 of the Ichihashi reference, the small-dimension measurement system comprises an electron optical column 11, an electron gun 12 configured to emit an electron beam 13, a deflector 14 for deflecting the electron beam 13, and an electron lens 15 for focusing the deflected electron beam 13. The system also includes detectors 19 and 20, such as photomultipliers or SSDs, which are disposed symmetrically with respect to the electro-optical axis for detecting electrons emitted or reflected by the sample 16. Of particular importance is the fact that the Ichihashi reference is directed toward a measurement system which would require detecting electrons and is not directed towards an electron beam lithography system.

The Examiner has also cited the Kasahara reference. The Kasahara reference discloses an electron beam lithography system having a first electron gun 10 and a second electron gun 32 in Figure 1. As depicted in Figure 1, the electron beam emitted from the first electron gun 10 passes through a first condenser lens 12 , a deflector 22, a plate 24 (appears to be an aperture), a second condenser lens 1, a blanking electrode 26 for deflecting the electron beam, a plate 28 (appears to be an aperture), a third condenser lens 16, and an objective lens 18. The electron beam is used to effect electron beam lithography of a resist disposed on a substrate 20. With continuing reference to Figure 1, a second electron beam emitted from the second electron gun 32 passes through a fourth condenser lens 34, the deflector 22, the plate 24, the second

condenser lens 1, the blanking electrode 26 for deflecting the electron beam, the pate 28, the third condenser lens 16 , and the objective lens 18. Thus, the electron beam emitted from the second electron gun 32 must pass through the many of the same apertures and lenses as an electron beam emitted from the first electron gun 10. In operation, the controller of the electron beam lithography system disclosed in Figure 1, alternates between using the first electron gun 10 and the second electron gun 32 to expose the resist. The Kasahara reference does not disclose or fairly suggest an electron beam lithography system having two electron sources, wherein each electron beam emitted therefrom passes through a corresponding aperture and focusing device. In other words, the Kasahara reference does not disclose or fairly suggest that each electron beam does not share any common apertures or focusing devices. In fact, the Kasahara reference suggests just the opposite. Furthermore, the Kasahara reference does not disclose or fairly suggest employing any type of detector for detecting electrons reflected or emitted from the semiconductor wafer that is irradiated by the electron beams.

Turning now to the claims, the patentably distinct differences between the cited references and the claim language will be specifically pointed out. The Examiner rejected claims 1-2 and 11 under 35 U.S.C. § 102(e) as being anticipated by the Mitsui reference. Claim 1 recites, in part, "a support aligned with the electron beam and having a support surface to engage the semiconductor device and support the semiconductor device, one of the electron beam and the support being movable relative to the other of the electron beam and the support in any of the x, y, or z planes." The Mitsui reference does not expressly or inherently disclose that "one of the electron beam and the support being movable relative to the other of the electron beam and the support in any of the x, y, or z planes" as recited in claim 1. Therefore, independent claim 1 is allowable over the cited reference. Claims depending from claim 1 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

Claims 12-14 were rejected under 35 U.S.C. § 102(e) as being anticipated by the Muraki reference. Claims 15-17 and 19 were further rejected under 35 U.S.C. § 103(a) as being obvious over the Muraki reference as applied to claim 12 above, and further in view of the Ichihashi reference. Independent claim 12 has been amended to incorporate the limitations of dependent claim 15. Thus, presently amended independent claim 12 includes two detectors for

detecting electrons from the semiconductor device. Presently amended independent claim 12 recites, in part, "a first detector spaced apart from the support to receive a first flow of electrons from the semiconductor device and generate a first signal corresponding thereto, and a second detector spaced apart from the support to receive a second flow of electrons from the semiconductor device and generate a second signal corresponding thereto." The Examiner rejected in the Office Action dated March 12, 2004 the above limitations of dependent claim 15 under 35 U.S.C. § 103(a) in view of the combination of the Muraki reference and the Ichihashi reference. Applicants submit that there is no motivation or suggestion to combine the teachings of the electron beam lithography system of the Muraki reference with the detectors disclosed in the Ichihashi reference. It is not apparent from the Muraki reference and the Ichihashi reference why one of ordinary skill in the art would modify the electron beam lithography system of the Muraki reference to include a detector. It is not apparent to the Applicants of what use an electron detector would serve in the electron beam lithography system of the Muraki reference. Assuming *arguendo* that the Ichihashi reference teaches eliminating alignment measurement errors in its small-dimension measurement system, the elimination of the alignment errors is to improve the measurement accuracy of the measurement device disclosed therein. The Muraki reference is not directed to a small-dimension measurement system and is directed to an electron beam lithography system where an electron detector would serve no function. Any modification of the electron beam lithography system of the Muraki reference to include a detector would be the result of impermissible hindsight. Therefore, presently amended independent claim 12 is allowable over the cited references. Claims depending from claim 12 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

Independent claim 20, as amended, is also patentable over the cited references. Claims 20-22 were rejected under 35 U.S.C. § 103(a) as being obvious over the Kasahara reference in view of Muraki reference. Claims 23-27 were rejected under 35 U.S.C. § 103(a) as being obvious over the Kasahara reference and the Muraki reference as applied to claim 20 above, and further in view of the Ichihashi reference. Presently amended independent claim 20, recites, "first and second sources of electrons; a first lens positioned proximate to the first source of electrons to receive a first electron beam emitted therefrom; a second lens positioned proximate to the

second source of electrons to receive a second electron beam emitted therefrom; a port surface having a first port and a second port therethrough, the first port spaced apart from the first lens to receive the first electron beam passing through the first lens, the second port spaced apart from the first port and from the second lens to receive the second electron beam passing through the second lens; a third lens configured to focus the first electron beam on a first position surface and positioned to receive the first electron beam passing through the first port; a fourth lens configured to focus the second electron beam on a second position surface and positioned to receive the second electron beam passing through the second port ; and a support configured to engage the semiconductor device and located to receive the first and the second electron beams, one of the support and the sources of electrons being movable relative to the other of the support and the sources of electrons in any of the x, y, or z planes." The Kasahara reference and the Muraki reference do not, individually or in combination, teach or suggest all of the limitations of presently amended independent claim 20. The Kasahara reference and the Muraki reference do not teach or suggest first and second sources of electrons wherein each electron beam emitted from the respective sources pass through a respective port and lenses. By employing the apparatus of claim 20, the two electron beams may operate independently and also simultaneously. In contrast, the Kasahara reference teaches that the electron beam emitted from the first electron gun 10 and the second electron gun 32 should share a common aperture 24, lens 14, deflector 22, lens 16, and lens 18. Due to sharing these common features, the two electron guns cannot operate simultaneously. The Kasahara reference thus teaches away from the subject matter of claim 20. The Muraki reference and the Ichihashi reference do not remedy any of the deficiencies of the Kasahara reference. Therefore, presently amended independent claim 20 is allowable over the cited references. Claims depending from claim 20 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

Dependent claim 23 recites "a first detector spaced apart from the support to receive a first flow of electrons from the semiconductor device and generate a first signal corresponding thereto, and a second detector spaced apart from the support to receive a second flow of electrons reflected from the semiconductor device and generate a second signal corresponding thereto." Applicants submit that there is no motivation or suggestion to combine the teachings of the dual electron source electron beam lithography system of the Kasahara

reference with the detectors disclosed in the Ichihashi reference. It is not apparent from the Kasahara reference and the Ichihashi reference why one of ordinary skill in the art would modify the electron beam lithography system of the Kasahara reference to include a detector. It is not apparent to the Applicants of what use an electron detector would serve in the electron beam lithography system of the Kasahara reference. Assuming that the Ichihashi reference teaches eliminating alignment measurement errors in its small-dimension measurement system, the elimination of the alignment errors is to improve the measurement accuracy of the measurement device disclosed therein. The Kasahara reference is not directed to a small-dimension measurement system and is directed to an electron beam lithography system where an electron detector would serve no function. Any modification of the electron beam lithography system of the Kasahara reference to include a detector would be the result of impermissible hindsight. Furthermore, the Muraki reference does not remedy any of the deficiencies of the Kasahara reference and Ichihashi reference.

All of the claims remaining in the application, i.e. claims 1-14 and 16-27, are now clearly allowable. Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,
DORSEY & WHITNEY LLP

Marcus Simon
Registration No. 50,258
Telephone No. (206) 903-8787

MSS:dms
Enclosures:
Postcard
Check
Fee Transmittal Sheet (+copy)

DORSEY & WHITNEY LLP
1420 Fifth Avenue, Suite 3400
Seattle, WA 98101-4010
(206) 903-8800 (telephone)
(206) 903-8820 (fax)
h:\ip\documents\clients\micron technology\400\500414.02\500414.02 amend oa 031204.doc